

CLAIMS

We claim:

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1 A method for performing an ion implantation comprising:

providing a target chamber for containing a target for implantation and an ion source chamber including an ion source for generating an ion beam;

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providing a beam deceleration optics that includes a beam deceleration means in said ion source chamber for decelerating said ion beam for producing a low energy ion beam;

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providing a beam steering means to said beam deceleration optics to separate neutralized particles out of said ion beam by keeping said neutralized particles propagating in a neutralized-particle direction slightly different from a steered targeted ion-beam direction; and

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employing said ion-beam deceleration optics for transmitting said ion beam along said targeted ion-beam direction to said target for implantation and for blocking said neutralized particles from reaching said target for implantation.

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2. The method of performing an ion implantation of claim 1 wherein:

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providing an analyzer magnet to said ion source chamber for mass filtering.

3. The method of performing an ion implantation of claim 1  
wherein:

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said step of employing said beam deceleration means  
further includes a step of providing a deceleration electric-  
field means for generating a deceleration electric-field for  
decelerating said ion beam for producing a low energy ion  
beam.

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4. The method of performing an ion implantation of claim 1  
wherein:

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said step of employing said ion beam steering means for  
generating an electrostatic field for keeping said neutralized  
particle to transmit along a trajectory different than said ion  
beam carrying electric charges comprising a step of steering  
said ion beam to transmit in a targeted ion-beam direction  
slightly different from said neutralized-particle direction.

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5. The method of performing an ion implantation of claim 1  
wherein:

said step of employing an ion-beam deceleration optics  
further includes a step of employing a neutralized beam  
blocking means for blocking said neutralized particle from  
reaching said target of implantation in said target chamber.

6. The method of performing an ion implantation of claim 1  
wherein:

5                    said step of providing an ion source in an ion source  
chamber is a step of providing an ion source for generating a  
positive charged ion beam; and

10                  said step of employing said beam deceleration means  
includes the step of employing a deceleration electric-field  
means for generating a negative electric-field for  
decelerating said ion beam for producing a low energy ion  
beam.

- 15                  7. The method of performing an ion implantation of claim 1  
wherein:

20                  said step of employing said ion beam steering means  
comprising a step of steering said ion beam carrying electric  
charges to transmit in said targeted ion-beam direction at a  
small deflected angle.

- 25                  8. The method of performing an ion implantation of claim 7  
wherein:

30                  said step of employing said ion beam steering means to steer  
said ion beam carrying electric charges to transmit in said  
targeted ion-beam direction comprising a step of steering  
said ion beam at a small deflected angle in a range of three  
to fifteen degrees relative to the horizontal axis.

9. The method of performing an ion implantation of claim 1  
wherein:

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said step of providing said ion source in said ion source chamber comprising a step of providing said ion source chamber and said target chamber with a vacuum in the range of  $10^5$  Torr; and

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said step of employing said ion beam deceleration means comprising a step of decelerating said ion beam to an energy level as low as about 200 eV with an energy contamination of less than about 0.1%.

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10. A method for generating an implantation ion beam from an ion source projecting a plurality of ions comprising:

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employing a beam deceleration means for decelerating said ions projected from said ion source;

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employing a beam steering means for generating an electrostatic field for separating a plurality of neutralized particles from said ion ions by keeping said neutralized particles propagating in a neutralized-particle direction slightly different from a targeted ion-beam direction of said ions.

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11. A method of claim 10 further comprising:

arranging a wafer implant position corresponding to said targeted ion-beam direction for accepting said ions projected thereto.

12. The method of claim 10 further comprising:  
said step of transmitting said ions to a target of implantation  
further comprising a step of employing a means for  
blocking said neutralized particles from reaching said target  
of implantation.
13. The method of claim 10 wherein:  
said step of separating said neutralized particles from said  
ions comprising a step of providing a charged particle  
deflection means for deflecting said trajectory of said ions at  
a small angle from said trajectory of said neutralized  
particles.
14. The method of claim 10 further comprising:  
configuring said ion beam deceleration means for  
decelerating and processing said ions into an ion beam  
having a large beam-height to beam-width ratio.
15. The method of claim 10 further comprising:  
providing a beam block for blocking said neutralized  
particles propagating in said neutralized-particle direction.
16. The method of claim 10 further comprising:  
projecting said ions in forming said implantation ion beam  
with high beam current and low and a ratio of a beam  
height to a beam width equal or larger than 20.

17. The method of claim 16 wherein:

5                    said step of forming said implantation ion beam having a ratio of a beam height to a height to a beam width equal or larger than 20 comprising a step of providing an extraction aperture for said ion source with an aspect ratio equal or larger than 20.

- 10                 18. The method of claim 10 wherein:

15                 said step of configuring said ion beam deceleration means for decelerating and processing said ions into an ion beam having a large beam-height to beam-width ratio comprising a step of processing said ions into an ion beam having a beam-height to beam-width ratio equal or greater than 4.

- 20                 19. The method of claim 18 wherein:

25                 said step of processing said ions into an ion beam having a beam-height to beam-width ratio equal or greater than 4 comprising a step of providing an aperture of a deceleration and steering optics having a beam-height to beam-width ratio equal or greater than 4.

- 30                 20. The method of claim 13 wherein:

                      said step of providing a charged particle deflection means for deflecting said trajectory of said ions at a small angle from said trajectory of said neutralized particles comprising a step of deflecting said trajectory of said ions at an angle in the range of three to fifteen degrees.